

Letter to Editor

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Syngamy, pronucleus, pronuclear breakdown and zygote

Mário Sousa¹✉, Jan Tesarik²¹Laboratory of Cell Biology, Department of Microscopy, Institute of Biomedical Sciences Abel Salazar (ICBAS), University of Porto, Rua Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal²MARGen Clinic Granada, Camino de Ronda, 2, 18006 Granada, Spain

The terms syngamy, pronucleus, pronuclear breakdown and zygote are common for experts dealing with reproductive cell morphology. However, these terms are often not correctly used in scientific and didactic literature.

At fertilization, the sperm postacrosomal plasma membrane fuses with the oocyte plasma membrane (oolema). Together with the release of a sperm soluble factor into the oocyte cytoplasm, this event triggers calcium oscillations[1] that activate the oocyte. Oocyte activation encompasses the cortical reaction, meiotic resumption with second polar body (PB2) extrusion and female pronucleus (PN) formation[2], organelle restructuring[3] and metabolic activation. Cortical contractions assist sperm incorporation, while the sperm membrane is included in the oolema[4]. The sperm nucleus decondenses to give rise to the male PN[5], and the sperm microtubule-organizer center assists the assembly of the zygote asters[6], as the oocyte meiotic spindle is anastral.

Regarding PN migration and positioning, evidence suggests that the zygote aster polymerizes radial microtubules that, when reaching the female PN begins depolymerisation, bringing both PN towards the zygote center[7]. Other studies indicate that a cytoskeleton lattice promotes PN migration, at different paces, towards the oocyte center, driven by microtubule motors[8]. When juxtaposed (Figure 1), the nuclear envelopes of both PN fragment (lamin phosphorylation/microtubule tension) and DNA originating from both gametes become intermingled. Nuclear envelope fragments are reused (lamin dephosphorylation) to encapsulate the nuclei of the first two blastomeres[7].

About 5 h after insemination the PB2 is extruded and both PN enter the G1-phase (zygote stage). Thereafter, both PN enter the S-phase (DNA replication), followed by the G2-phase and finally the M-phase (chromosome condensation)[9]. During the G2-phase, pronuclear breakdown (PNBD) was observed to occur[9].

In conclusion, in human fertilization and in terms of cell biology, syngamy refers to the fusion between gametes (membrane fusion).

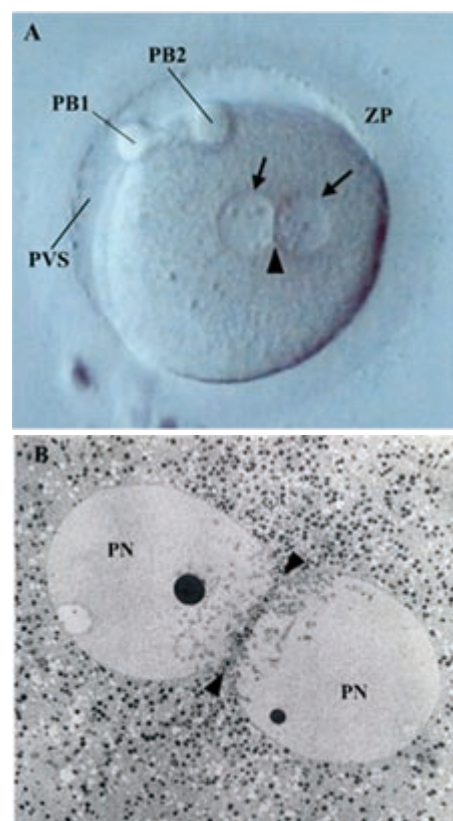


Figure 1. Zygote pronuclear juxtaposition. A. Live cell image obtained by inverted microscopy. Note the juxtaposition (arrowhead) of the two pronucleus (arrows). ZP: zona pellucida; PVS: perivitelline space; PB1: first polar body; PB2: second polar body. B. Image obtained by transmission electron microscopy. Note the juxtaposition (arrowheads) of the two pronucleus (PN).

✉To whom correspondence may be addressed. E-mail: msousa@icbas.up.pt

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After fertilization, a female and a male PN form, without PN fusion (karyogamy), pronuclei then juxtapose, followed by PNBD, with the term Zygote referring to the stage from the time both PN form. Based on the above review, we expect that authors of didactic texts confidently update those definitions. Additionally, in Glossaries for reproductive clinicians, these terms should also be correctly employed. *The International Glossary on Infertility and Fertility Care*[10] is extremely useful for clinicians and researchers, as it allows the same clinical and biological terms to be used in the presentation of scientific results. Further more, we expect that in the following version of this Glossary these terms could also be updated, with the term Syngamy being defined as “The process during which the female and male gametes fuse”, and the term Pronucleus as “A round structure in the oocyte surrounded by a membrane containing chromatin. Normally, two pronuclei are seen after fertilization, each containing a haploid set of chromosomes, one set from the oocyte and one from the sperm”.

Conflict of interest statement

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Authors' contributions

Mário Sousa and Jan Tesarik both wrote the paper.

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